Inventors: Satoshi SHINADA, et al.
Appln No. 09/698,143
Filing Date: October 30, 2000
Grant K. Rowan
Q60866
(Tel) (202) 293-7060
(Fax) (202) 293-7860

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

VERIFICATION OF TRANSLATION

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

Sir:

I, Atsunori Murata, of 1-14 Higashi-hiratsuka-cho, Naka-ku, Hiroshima 730-0025 declare:

(1) that I know well both the Japanese and English languages;

(2) that I translated the Japanese document entitled "Ink cartridge for use with an ink jet recording apparatus" from Japanese to English;

(3) that the attached English translation is a true and correct translation of the above-identified Japanese document to the best ofmy knowledge and belief; and

(4) that all statements made of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 USC 1001, and that such false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated: October 21,2002

Atsunori Murata

Atsunori Murata

J0078529 (2001-310480)

[Name of Document] Specification
[Title of the Invention] Ink cartridge for use with an inkjet recording apparatus

What is claimed is:

[Claim 1] An ink cartridge for use in an ink jet recording device, comprising:
an ink cartridge formed from a substantially parallelepiped container, stored in the holder of a carriage, having a storage chamber prepared, communicating via an ink supply port with an ink supply needle of an recording head installed on the carriage, said ink supply port positions towards one of short side walls, a concave portion is formed, protruding to the other short side wall at said ink storage chamber side, at least one rib is formed, protruding to said the ink supply port side, parallel to the long side at said concave portion, an absorbent is formed from an elastic porous member, the length of the absorbent corresponds to the length of the ink storage chamber regulated by said rib and is supported by said wall and said rib.

[Claim 2] The ink cartridge for use in an ink jet recording apparatus according to claim 1, wherein said ink absorbent is compressed by a lid member which comprises said container at an ink exhaust port, communicating to said ink supply port.

[Claim 3] The ink cartridge for use in an ink jet recording apparatus according to claim 1, wherein said container is divided into a plurality of ink storage chambers by partitions, and said concave portion is formed so as to straddle said partitions.

[Claim 4] The ink cartridge for use in an ink jet recording apparatus according to claim 3, wherein ribs are formed from short side walls in one of the multiple ink storage chambers that is partitioned by said container side wall.

[Claim 5] The ink cartridge for use in an ink jet cartridge according to claim 1, wherein the projection length of said rib is adjusted to the volume of ink to be stored.

[Claim 6] The ink cartridge for use in an ink jet recording device according to claim 1, wherein said concave portion functions as the positioning portion for said holder.

[Detailed Description of the Invention]
[0001]
[Field of the Art]
The invention relates to an ink cartridge for supplying ink to a recording head. The ink cartridge is mounted on a carriage in which a recording head for jetting ink droplets is attached.

[0002]
[Related Art]
An ink jet recording apparatus prints images of photo-like quality with a relatively simple structure, so that it is widely used as a recording apparatus for personal use. In such a recording apparatus, recording heads for a black ink and color inks are generally mounted on a carriage, then cartridges for the black ink and the color inks are installed thereon, and inks are supplied to each recording head via an ink supply needle.

[0003]
[Problem to be solved by the invention]
In the case that most of the printing to be printed by the recording apparatus is composed of text date, the amount of the color inks to be used is small and the color inks are not frequently used, so

that the frequency of an exchange of the color ink cartridge is much lower than that of the black ink cartridge. Accordingly, there is a problem that the effective date of the color ink cartridge expires before the consumption of all of the color inks, which requires the premature replacement of the color ink cartridge, there by increasing the cost. On the other hand, when a color printing is often conducted, the black ink is not frequently used, and the effective date may expire before consuming all of the ink in the black cartridge. This makes exchange necessary and leads to a problem with increased running costs. Moreover in personal use, the recording apparatus itself is not used frequently. Because of this, the effective date expires with ink remained in both black and color ink cartridges.
In order to solve these problems, as shown in the Japanese published application no. 9-262988, a filler is inserted in the bottom of a container comprising a normal volume ink cartridge so as to decrease the ink filling amount of a ink absorbent. However, this will change the pressure characteristics and the shape adjacent to an ink supply port, which greatly affects the ink supply characteristics to a recording head. Therefore, the printing characteristics may degrade. In view of such problems, the present invention has the objective of providing an ink cartridge with a small volume, providing the same ink supply characteristics as those of an ink cartridge with a normal volume.

[0004]
[Means for solving the problem]
In order to solve these problems, in the present invention, an ink cartridge is composed of a substantially parallelepiped container, stored in a carriage holder. An ink storage chamber is prepared in the container, communicating via an ink supply port with an ink supply needle of a recording head installed on said carriage. Said ink supply port positions towards one of the short side walls. Also, a concave portion is formed, protruding to the ink storage chamber side at the other short side wall. At least one rib is formed, protruding to said ink supply port side, parallel to the long side at said concave portion. An ink absorbent, comprised of an elastic porous member, whose length corresponds to the length of the ink storage chamber, and regulated by said ribs, is supported by said ribs and the other said wall.

[0005]
[Effect]
The ink supply port side receives the same pressure as in a normal volume ink cartridge in which ribs are not installed. Ribs extend at the opposite side of the ink supply port, regulating the volume of the ink storage chamber according to the volume of ink that should be stored. The ink absorbent is manufactured to correspond to the height of the ink chamber. Irrespective of the volume of ink filled, the ink cartridge's static and dynamic characteristics can be held constant. Also, changing the length of the ribs extending to the ink supply port side regulates the substantial volume of ink that can be stored. The metal mold for the outside of the container can be standardized, and when the positioning and shape standards are set according to the outer dimension of the container, and the manufacturing line can be standardized.

[0006]
[Embodiment of the invention]
What follows is an explanation based on an embodiment illustrating the details of the present invention. Figures 1 through 5 show embodiments for a cartridge that stores one kind of ink such as black ink. A container 1 that comprises the ink cartridge can be installed and removed from a cartridge holder of the carriage. It is formed in a substantially parallelepiped shape at a scale that does not cause rattling. (In this embodiment, a parallelepiped shape includes those in which the upper surface side is slightly expanded.) An opening 2 is prepared on the upper surface, and on the lower surface, an ink supply port 5 is formed, communicating with a recording head at one of the short sides 4 of the container. At the lower portion 6 of the container 1, a convex portion 8 is formed, which is prepared with an ink outflow hole 7, communicating to the ink supply port 5, and a filter 9 is attached on the top of this portion.

[0007]
One of the other short side walls 10 of the container 1 extends from the bottom half of the container to the bottom portion 6. A concave portion 11 with a width W2 that is narrower than the width W1 of the short side is formed. This concave portion 11 functions to position the container against a pallet used during manufacturing, and also functions as the guide portion material for the cartridge holder, and prevents insertion errors.

[0008]
When making an ink cartridge with a small volume as in this embodiment, two ribs 13 and 14 are formed with a same shape, parallel to the long side wall, at a surface 11a of portion 11 protruding to the inner portion of the container.

[0009]
In the space of the container 1 constructed in this way, namely in an ink chamber 15, a rectangular parallelepiped ink absorbent 16 made from an elastic porous member, is inserted from the opening 2. After sealing with a lid member 19 on which an ink injecting port 17 and an air communicating port 18 are formed, ink is injected to the ink absorbent 16 from the ink injecting port 17, and a ink cartridge 20 is complete. In the above-mentioned embodiment, since the two ribs 13 and 14 are formed in parallel, the ink absorbent 16 does not shift unnecessarily when inserted.

[0010]
As shown in Fig. 5(a), the ink absorbent 16 is slightly larger than the width W1 of the opening 2 of the container 1. The length L2 is slightly larger than the length L1, the distance from the short side wall 4 positioned by ink supply port 5 to the leading edge of the ribs 13 and 14. Therefore, as shown in Fig. 5(b), when the container 1 is sealed with a lid member 19, the leading edge of an ink outflow port 7, namely the area in contact with a filter 9, is more strongly compressed than other areas by the convex portion 8, making use of the strong capillary force.

[0011]
The ink absorbent 16 is compressed at the ink supply port 5 in the same way as for a normal volume ink cartridge (Fig. 6), described later, which does not have ribs. The ribs 13 and 14 press the other edge, which has no relation to ink flow discharge. Therefore even if the absorbent member 16 has less volume to absorb ink, it has the same ink supply characteristics as an ink cartridge with a normal volume.

[0012]
Because these ink container bodies 1 are usually manufactured by injection molding with polymer material, metallic molds are prepared. Accordingly, the external metallic mold can be standardized with one for normal volume container bodies 1. As to the internal metallic mold, a slight redesign, such as adding a convex portion for injecting resin to form the ribs 13 and 14, produces a small volume ink cartridge container. Because no change to the external shape results even if the volume is minimized, the manufacturing line for normal volume ink cartridges is also used for small volume cartridges, thereby decreasing equipment costs.

[0013]
In other words, the width of the ink cartridge with a normal volume, as shown in Fig. 6 (a), is the same as that of the ink cartridge with a small volume. However, the length L4 of the ink absorbent 16' is larger than the length L3, the distance from the short side wall 4 positioned by the ink supply port 5 to the other short side wall 4. Accordingly, as shown in Fig. 6(b), when the container 1 is sealed with the lid member 19, the ink supply port 5 side is compressed in the same way as in small volume ink cartridges in which the ribs 13 and 14 are provided.

[0014]

The structure of small volume containers with the same outer dimensions as for normal volume containers can be applied to ink cartridges storing multiple types of ink, such as cartridges for color ink.

[0015]
Figs. 7 through 9 show an embodiment in which multiple types of ink are stored in one cartridge. A container 31, which can be installed and removed from a cartridge holder of a carriage, is formed as a rectangular parallelepiped at a scale that does rattle in the holder. In this embodiment, partitions 35 and 36 are formed so as to divide the ink chambers 32, 33, and 34.

[0016]
An opening 37 is provided on the upper surface of the container 31. On the bottom surface 38, ink supply ports 42, 43 and 44 are formed, communicating with the recording head at the short side walls 39, 40 and 41 of each of the ink chambers 32, 33 and 34. On the bottom portions 45, 46 and 47 of each of the ink chambers 32, 33 and 34, convex portions 51,52 and 53 are formed. These are provided with ink outflow holes 48, 49 and 50, communicating with the ink supply ports 42, 43 and 44. Filters 54, 55 and 56 are provided on the top of these portion.

[0017]
At the other short side walls 57, 58 and 59 of each of the ink storage chambers 32, 33 and 34, concave portions 60 and 61 are formed. These extend to the lower portion from the lower half of the container 31, so as to make the partitions 35 and 36 into a symmetric line. The concave portions 60 and 61 function to position the container against a palette used during manufacturing, and also function as the guide portion material for the cartridge holder, and prevent insertion errors.

[0018]
As shown in this embodiment, when an ink cartridge with a small volume is formed, two pairs of ribs 63, 64 and 65, 66 are formed with the same shape, parallel to the long wall 62 at the surfaces 60a and 61a, protruding from the concave portions 60 and 61 of the container. They are positioned in each of the ink storage chambers 32, 33 and 34.

[0019]
In the ink chambers 32 and 34, which use the longer side walls as partitions, ribs 67 and 68 extends directly from the shorter side wall, and formed parallel to the ribs 63 through 66, and those leading edges are at the same position as the leading edges of the ribs 63 through 66 formed in the concave portions 60 and 61.

[0020]
Even in this embodiment, when forming a small volume cartridge, an ink absorbent 69 is inserted (Fig. 10(a)), as in the previously described embodiment. The length of the absorbent is longer than L5, the distance from the leading edge of ribs 63 through 68 to the opposite side wall. Also, when forming a cartridge with a normal volume, an absorbent 69' is stored (Fig. 10(b)), the length of which is longer than the distance from the surfaces 60a and 61a of the concave portions 60 and 61 to the ink supply port side's wall. Reference numeral 70 in the figure shows a lid member in which an ink injecting port 71 and an air communicating port 72 are formed.

[0021]
In these ink cartridges with a small and normal volume, as in the previous embodiment, the ink absorbents 69 and 69' are compressed in the same way by the convex portions 51, 52 and 53, communicating with the ink supply ports 42, 43 and 44, so that the same ink supply characteristics are maintained regardless of ink storage volume.

[0022]
In the above-mentioned embodiment, two ribs are formed in the ink chamber. However, the same

effect can be achieved if one rib, positioned at the center line, or three or more ribs are formed, at a scale that does not cause unnecessarily large shifting of the ink absorbent. The explanation of the above-mentioned embodiment of a color ink cartridge is for the case in which three colors of inks are stored. However, the same effect is achieved in applications in which four (4) or more types of ink are stored.

[0023]
[Effect of the invention]
As explained above, in the present invention, an ink cartridge is composed of a substantially parallelepiped container, stored in a carriage holder. An ink storage chamber is prepared, communicating via an ink supply port with an ink supply needle of a recording head installed in a carriage. The ink supply port is positioned towards one of the short side walls. A concave portion is formed, protruding to said ink supply port side at the other short side wall. Ribs are formed at the concave portion, protruding to the ink supply port side and parallel with the long side wall . An ink absorbent made from an elastic porous member and having a length corresponding to that of the ink chamber, is supported by the other side wall and the ribs. Therefore, since the ink supply port side is compressed in the same way as in an ink cartridge with a normal volume and no ribs, the same ink supply characteristics result. Also, It is possible to manufacture a reduced volume container by slightly changing the design data for the metallic mold used for normal volume container bodies. In addition, the same outer dimesions as that of a normal volume cartridge is maintained. Therefore, changes to the manufacturing line are not necessary and manufacturing costs can be decreased.

[Brief explanation of the diagrams]
Fig. 1 shows one embodiment of the container of an ink cartridge for use with an ink jet recording head of the present invention, with the lid removed.

Fig. 2 is an upper surface view showing the structure of the area below the concave portion of the ink cartridge in Fig.1.

Figs. 3 (a) and (b) both show the cross-sectional structure along lines A-A and B-B of Fig. 2.

Figs. 4 (a) (b) and (c) are side views showing the cross-sectional structure along lines C-C and D-D of Fig. 2.

Figs. 5 (a) and (b) both show the assembly process of the ink cartridge of the present invention.

Figs. 6 (a) and (b) show the assembly process of the ink cartridge of the present invention, when used as a normal volume ink cartridge.

Fig. 7 shows the container forming another embodiment of the ink cartridge for use with an ink jet recording head of the present invention, with the lid removed.

Figs. 8 (a) and (b) show a top view and a side view of the lower region of another embodiment of the ink cartridge of the present invention, capable of storing multiple types of ink.

Figs. 9 (a), (b) and (c) show the cross-sectional structure along lines E-E, F-F and G-G of Fig. 8.

Figs. 10 (a) and (b) are cross-sectional views of an embodiment of the small volume ink cartridge and of a normal volume cartridge, which can store multiple types of ink, respectively.

[Explanation of symbols]
1. Container
5. Ink supply port
7. Ink outflow hole

11. Concave portion 1
13, 14. Ribs
15. Ink supply chamber
16. Ink absorbent

[Abstract]
[Objective]
The present invention provides an ink cartridge with a small volume, and the same ink supply characteristics of an ink cartridge with normal volume.
[Means for solving problem]
An ink supply port 5 positions towards one of the short side walls 4. Also, a concave portion 11 is formed, protruding to the inner portion at the other short side wall 10. Ribs 13 and 14 are formed, protruding to the ink supply port side, parallel to the long side wall 12 at the concave portion 11. An ink absorbent 16, the length of which corresponds to the length of the ink supply chamber, is regulated by one of the walls 4 and the ribs 13 and 14.